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U. S. DEPARTMENT OF AGRICULTURE.

FARMERS' BULLETIN No. 164.

RAPE AS A FORAGE CROP.

BY

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF PLANT INDUSTRY,
Washington, D. C., December 13, 1902.

SIR: I have the honor to transmit herewith a paper on Rape as a Forage Crop, and respectfully recommend that it be published as a Farmers' Bulletin. The paper was prepared by Prof. A. S. Hitchcock, Assistant Agrostologist, and was submitted by the Agrostologist.
Respectfully,

B. T. GALLOWAY,
Chief of Bureau.

Hon. JAMES WILSON,
Secretary of Agriculture.

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RAPE AS A FORAGE CROP.^a

INTRODUCTION.

Throughout the northern portion of the United States farmers and stock raisers could advantageously grow more of the succulent forage crops for feeding stock during the summer and autumn months, when the supply of grasses and clovers is often limited. Such crops may usually be grown on land that has already produced an early maturing crop of some sort, such as oats, rye, or winter wheat. One of the best

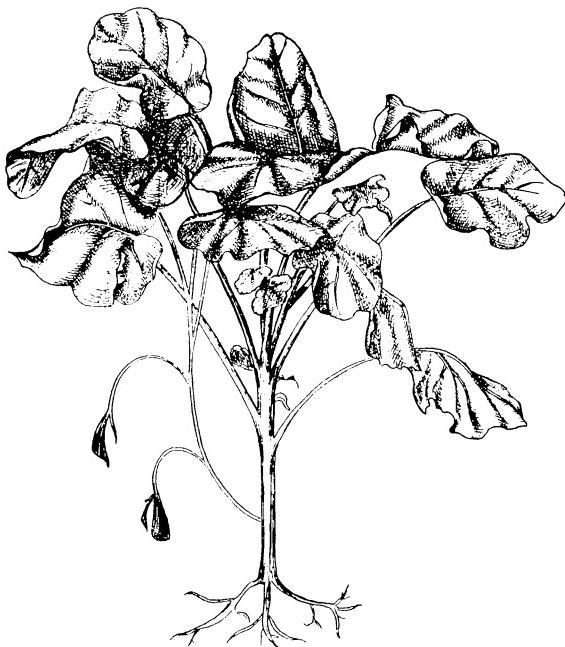


FIG. 1.—The rape plant.

of these succulent crops is rape (*Brassica napus* Linn.), a plant closely related to cabbage, turnips, mustard, and ruta-bagas.

DESCRIPTION.

Rape (fig. 1) is much like the Swedish turnip or ruta-baga in appearance, but the root is more like that of cabbage. The leaves are large,

^aThe present bulletin includes much of Circular No. 12, Division of Agrostology, U. S. Department of Agriculture, by the late Thomas A. Williams, entitled "Rape as a Forage Plant."

smooth, spreading, variously notched and divided, and covered with a fine meal as the cabbage is. The flowers are bright yellow, nearly one-half inch in diameter. The seeds are produced in pods usually 2 inches or more long. They are black and globular, resembling the seed of the cabbage and turnip, but are somewhat larger than these.

Under ordinary field conditions the plant reaches a height of from $1\frac{1}{2}$ to 4 feet, and the strong-growing roots penetrate the soil to a considerable depth.

Rape is either annual or biennial. The annual varieties (summer rape) are grown chiefly for the seed, and have not been much cultivated in this country. The biennial varieties (winter rape) are used largely for forage.

VARIETIES.

All the varieties of rape that have come into prominence in American agriculture are winter or biennial sorts. Dwarf Essex or English rape has been most widely cultivated. Recently a variety has been placed on the market under the name of Dwarf Victoria rape, or simply Victoria rape, which has given excellent results in New England and also in the Northwest, yielding, as a rule, rather better than the Dwarf Essex. At the New Hampshire Experiment Station this variety is reported as yielding nearly 50 tons of green fodder per acre, and yields of 25 to 30 tons per acre are reported from South Dakota and elsewhere in the Northwest. Under average conditions a yield of from 10 to 20 tons or more may be expected from either of these varieties. It should be remembered that the annual varieties produce seed the first year and are worthless for fodder.

NATIVITY, USES, AND EXTENT OF CULTIVATION.

Rape, like the turnip, is a native of northern Europe, ranging eastward into Siberia. Although it has long been cultivated in the Old World, it has received but little attention in America until within comparatively recent years. In Europe, especially in England, summer rape is widely cultivated. The seed yields about 33 per cent of expressed oil, which is of value for lubricating, and is also used for lighting. The compressed rape-seed cake is used as a food for stock and as a fertilizer. It is regarded as particularly valuable as a fertilizer for flax and turnips. The seed is much used as a bird food. In this country rape is grown almost exclusively for forage, being used chiefly for soiling, and summer and autumn pastureage.

Rape is best adapted to rather cool, moist climates, such as prevail in portions of Canada and the Northern United States. It can, however, be successfully grown as a forage crop in many of the warmer

and drier sections. In the Northern States the biennial rape will not survive the winter; hence does not produce seed. In the South it may be grown as a fall or winter forage. The annual varieties used for the production of oil form seed the first year, but these kinds are not suitable for forage. In favorable seasons, or with a small amount of irrigation, excellent crops of rape are grown in Wyoming, Montana, the Dakotas, and other States in the so-called semiarid region, and many instances are on record where good crops have been produced without irrigation, under conditions of drought so severe as to cause the failure of corn and other farm crops.

In the Middle South rape can not compete with crimson clover for forage.

SOIL REQUIREMENTS.

For its best development rape requires a rich, moist, loamy soil, and will usually do well on any but light sandy soils and stiff clays, such soils being usually deficient in vegetable matter. In general, a soil that will produce good crops of turnips, cabbages, wheat, and corn will be suitable for rape.

Rape is a gross feeder, and draws quite heavily on the nitrogen as well as the mineral constituents of the soil, and hence should be used in rotation with crops that feed largely on other elements of plant food. For example, rape and fodder corn take about the same proportions of nitrogen, potash, and phosphoric acid from the soil, and experience has shown that corn does not do well after rape, unless the land is naturally rich in these substances. Results obtained at the North Dakota Experiment Station indicate that the growing of a crop of rape on land that has been sown to wheat for a number of years produces a decided increase in the yield of wheat from the succeeding crop. This is a point of much value in regions where wheat is extensively grown. On account of its power to utilize fertilizer and barnyard manure, rape is an excellent plant to grow upon land recently treated with manure. It is also an excellent plant for the first crop upon reclaimed swamp soil, and is well adapted to newly cleared woodland, the stumps being less of an interference than with most crops.

LOCATION OF THE FIELD.

On account of the manner in which the rape crop is used it is necessary to give attention to the location of the field with reference to convenience. Since it is advisable, especially with sheep, to allow the animals to have access to grass pasture, the rape field should be placed if possible next to such a pasture, so that there may be easy passage from one to the other. The danger from bloating is then much less. An advantage, though not a necessity, would be the presence of suffi-

cient shade to make the animals comfortable. If it is intended to use the crop for soiling, the field should be conveniently located for this purpose.

Attention should be paid to the size of the field in proportion to the number of animals to be pastured. Prof. John A. Craig states that it is safe to assume from the data available that 1 acre of rape, with grain, will fatten 20 wethers in two months. He found that 10 hogs would eat about one-third of an acre in two months.

PREPARATION OF THE SOIL.

Owing to the great variety of ways of utilizing rape and the many places it may occupy in the rotation of crops on the farm, there are numerous methods of culture that may be followed in growing it. When it is grown as the primary crop of the season, the land should be prepared by deep and thorough plowing, preferably early in the preceding autumn. In some soils a second plowing should be given in the spring before the seed is sown; but in soils that are naturally loose and mellow, such as are found in portions of the Northwest, a simple stirring of the surface with a cultivator or disk harrow will often be sufficient. The land should be well pulverized by harrowing before the seed is sown. When the land needs fertilizing, barnyard manure may be applied before plowing in the autumn, or if the land is plowed twice the manure may be spread on during the winter or early spring before the last plowing. Commercial fertilizers may be applied by harrowing in at the time that the land is being pulverized previous to seeding. Whatever treatment the land is given in preparation for this crop, it should be such as to afford a deep, mellow seed bed, as free as possible from noxious weeds. One of the advantages of the rape plant is the rapidity with which it grows under favorable conditions. It then produces a succulent, crisp, and tender foliage which is much relished. Hence it is desirable to supply a crop with sufficient plant food and adapt its early growth as much as possible to the usual rains. During prolonged dry weather the foliage becomes tough and somewhat leathery.

SEEDING.

Throughout the Northern States generally seeding may take place from the first week in May to the middle or last of July, according to the season and locality. In the South the seed may be sown in September or early in October. Under favorable conditions 2 to 3 pounds of seed per acre will be sufficient, and it will never be necessary to use more than 5 pounds per acre. The seed should be planted in drills far enough apart to allow cultivation. In practice the distance varies, but it is seldom less than 20 inches nor more than 32; 24 to 28 being perhaps the most satisfactory, all things considered. For planting small

fields any of the common garden drills will be found quite satisfactory, but for large fields a grain drill, with some of the feed hoppers closed may be used. When the ground is clean and in proper cultivation otherwise, good results may be obtained by using the grain drill with all feed hoppers open, and giving no after cultivation. As a rule, however, it will be best to plant in wide drills and give sufficient shallow cultivation to keep the soil in good physical condition and destroy weeds.

With favorable soil and climatic conditions, good crops of rape may be obtained from broadcast seeding; but whenever there is any danger of the surface soil becoming very dry during the time the seed is germinating or when land is at all foul, drilling will give much better results. When sown broadcast, 4 or 5 pounds of seed may be needed, but it is not advisable to sow too thickly as the plants do not make so vigorous a growth.

Drilling in rows has many advantages. The cultivation increases the yield, conserves the moisture, and keeps down the weeds. Furthermore, if the crop is to be pastured there is much less waste when the plants are in rows as the animals are inclined to follow between the rows rather than crossing them and trampling on the plants. Some advocate drilling the seed on ridges. This may be an advantage where there is an excess of moisture, as the plants have better drainage and the animals while feeding are less likely to cross the rows. On the other hand the crop will not withstand drought so well as when given level culture.

Rape resists drought fairly well, but in regions subject to a summer drought the sowing should take place early enough to get the plants well started before this period or it should be delayed until after the drought. During a prolonged dry period the plants are often attacked by a kind of plant louse which causes them to wilt and become valueless as forage. Where rape is depended upon as a chief crop, it is advisable to make several successive growings. If a particular crop comes on too early, it may be cut and thus make the second growth available later.

Rape seed is mostly imported, but can be grown in the Middle South and certain localities along the Pacific coast. Rape is reported to have become a troublesome weed in places along the Lower Columbia River, Oregon.

CULTIVATION OF THE CROP.

If the seed has been drilled, the crop should receive at least three or four cultivations during its early growth. This should commence as soon as the plants are large enough, and be continued until the plants have spread so much as to prevent further passage. If the crop is cut it is best to follow with a cultivator, as this causes the stems to send out new shoots more rapidly.

OREGON METHODS OF GROWING RAPE.

Prof. James Withycombe, of Corvallis, Oreg., makes the following statement regarding the growing of rape in that State:

Rape has been grown in Oregon for the past thirty years. Seed of the Dwarf Essex variety was brought here from England in 1871 by Thomas Withycombe, and the plant flourished from the start as the climatic and soil conditions were suitable to its growth. Notwithstanding the practical demonstration of the value of the plant for about twenty years in the locality in which it was first introduced, it did not attain its popularity and prominence as a forage crop until within the past five or ten years.

There are three general methods employed in the growing of rape in western Oregon. For early summer feed, either for pasturing or for soiling, the seed is sown in drills about $2\frac{1}{2}$ to 3 feet apart early in the spring on well-prepared ground. One and one-half pounds of seed per acre are usually sown, and as soon as the plants are well up they are cultivated with a single or two-horse cultivator. This operation is repeated about once a week during the growing season.

This diligent system of cultivating conserves moisture and insures a luxuriant and continuous growth. A good fall pasture is frequently secured by sowing from 2 to 3 pounds of rape seed per acre with the spring seeding of oats. The seed germinates and makes rather a vigorous growth at first, but as the season advances and the soil moisture grows less the plant withers and assumes an almost lifeless form. With the first fall rains, however, the plant takes on new life, as it were, and in a short period makes an excellent pasture. For this system the land should be comparatively rich and in good physical condition.

Perhaps the most popular and general method of growing rape in this State is broadcast seeding about the 1st of June. The land is usually plowed and worked down in the spring as soon as it is in condition, then allowed to lie until about the 1st of June, when from 2 to 3 pounds of rape seed per acre are sown broadcast. The seed is covered with a cultivator or disk harrow, after which the land is worked down fine. Rape sown in this manner makes a luxuriant pasture about the 1st of August, when it will carry from 5 to 10 sheep per acre for the greater part of the fall.

A popular method with many progressive agriculturists is to sow clover and rape together about the middle of May. They invariably secure a good stand of clover, and the two make a very satisfactory hog and sheep pasture through the autumn and early winter.

Rape is sometimes sown on corn ground just preceding the last cultivation, and with timely rains the rape will furnish a great deal of pasturage after the corn is harvested.

The winters in western Oregon are rarely severe enough to kill the plant; hence the opportunities here are exceptionally favorable for growing rape seed. A yield of 1,000 pounds of seed per acre is not unusual.

HARVESTING AND UTILIZING THE CROP.

The rape is usually ready for use in about 8 or 10 weeks from the date of seeding. The general practice is to use it as a soiling crop or as pasturage. Sheep and swine may be turned into the field and allowed to remain until the rape is pastured off. Cattle may also be allowed to run in the field, but as they waste much of the forage by pulling up the plants and trampling them down it is a better plan to cut the rape with a scythe or mower and feed it to them. While it may be

utilized for feeding cattle it is probably not as well suited for these as are some of the other succulent fodders. For this reason it may not be advisable to grow rape for cattle only.

Although rape can be used as a soiling crop and is so used in many places, it is doubtful whether it will supplant other plants for this purpose. Its chief use is for pasture, especially for hogs and sheep. Geese and other fowl will do well upon such pasture, and those who are raising poultry as a chief industry will find a field of rape a useful adjunct. It can not be recommended for curing as a dry fodder or for silage. It is so succulent that it cures with difficulty and it can not be compared to corn for silage.

In cutting rape for soiling it is best to cut about 4 inches from the ground. It is advisable to arrange the cutting so that each day's product will be consumed within that time, as the foliage soon wilts and is not then relished so much. Rape is especially valuable for breeding ewes in midsummer when the pastures begin to fail, as the succulent feed keeps up the supply of milk for the lambs. If the crop is to be cut the first week in July, the seed must be sown early in May, as it takes usually about two months to reach the proper stage for soiling. Furthermore, by sowing early, as many as three cuttings can be made during summer and fall.

FEEDING VALUE.

Rape has a high feeding value. It makes an excellent feed for fattening sheep and swine and for producing an abundant flow of milk in milch cows. On account of danger of tainting the milk many people do not feed it to the cows until after milking. Rape can be used to good advantage as a part of the ration for animals that are being fed in pens for market or for the show ring. It is also a valuable food for young lambs at weaning time. By beginning as early as practicable in the spring and seeding at intervals of two or three weeks, a continuous succession of rape can be produced throughout the period when the permanent pastures are most likely to be short. Rape will endure quite severe cold weather, and thus will last a long time after the ordinary pasture grasses succumb to the frost. By the use of this crop stock can be gotten into good condition for the holiday markets or for winter, and there need be no check in growth, fat, and milk production through insufficient succulent food during the late summer and autumn months, as is too frequently the case.

At the Guelph Station, Canada, rape was fed to dairy cattle with satisfactory results, no taint to the milk following its use. The cattle preferred the rape to all the other green fodders that were tried. At the Wisconsin Station, where much attention has been paid to growing rape for forage, a trial to show the value of this crop for pasture

resulted in a gain of $413\frac{1}{2}$ pounds of mutton from $9\frac{3}{4}$ tons of rape and 1,439.8 pounds of grain (wheat and oats). Experiments at the same station with hogs show that while excellent when combined with grain, rape does not give sufficient nourishment when fed alone. It was demonstrated that where fattening pigs were fed rape in conjunction with grain ration, one acre of rape had a feeding value equivalent to 2,657 pounds of grain, and that young pigs thrive better when pastured upon rape than on clover, grain being fed in both cases.

At the Iowa Station it was found that, compared with clover, rape caused a shrinkage of the milk flow.

At the Wisconsin Station the heaviest yield for three cuttings at about 4 inches from the ground was at the rate of 36 tons of green fodder per acre.

The Michigan Station has also experimented extensively with rape and reports favorable results. For pasture it is recommended to sow about July 1. At that place it was not found practicable to pasture later than November 15, as after the foliage became frosted the animals were subject to digestive disorders.

DANGER FROM BLOATING.

There is no danger to hogs from bloating, but cattle or sheep may suffer seriously if sufficient care is not taken. It is best to give the animals a full feed of grain just before they are turned into the rape. It is also advisable to allow the animals the run of a grass pasture or to have feed racks of hay or straw accessible. Salt should be freely supplied. There is little danger when animals are put upon rape for the first time, as it is usually necessary for them to acquire a taste for the plant. For pasturing lambs it is an excellent plan to employ hurdles or movable fences. The animals may be inclosed in a limited space and are not likely to get enough forage to cause damage. There is by this method less waste. Hurdling may be employed also for geese.

RAPE AS A CATCH CROP.

When rape is grown as a secondary or catch crop it will not often be possible to pay so much attention to the preparation of the soil and the time and method of seeding, and the quantity of seed used may be varied to suit the circumstances. Often fine rape may be grown on land that has already produced a crop of some of the early maturing cereals, such as rye, oats, or barley. As soon as the crop of grain is removed the land is plowed or disked and at once seeded to rape. Field peas and other early maturing forage crops or rye or winter oats that have been pastured off in spring may also be followed by rape with profitable results. Each year finds the area in which rape is grown extended until now it includes much of the spring-

wheat region of the Northwest, where it is grown chiefly as a catch crop after spring grain.

Another practice which is coming into favor in some sections of the country is to sow rape in the spring with some grain crop, such as wheat, allowing the former to take possession of the field when the latter has been removed. This is recommended for Nebraska by Professor Burnett, who sows broadcast on winter wheat at the rate of about 2 pounds per acre when the wheat is 2 or 3 inches high in the spring, or sows it upon oats when they are about the same height, following with a smoothing harrow. He states that in Minnesota and the Dakotas, with a good stand of rape in the stubble, sheep can be turned in about three weeks after cutting. Such a field will support 10 or 15 sheep per acre and keep them growing for six weeks. They feed on the weeds and scattered grain as well, which cleans the field and gives additional gain to the sheep.

Sowing rape with oats was tried at the Iowa Station, where the best results were obtained by using 6 pecks of oats and 1 pound of rape per acre, seeding the latter ten days after the oats. The soil was good, and a yield of 60 bushels of oats and 18 tons of green rape per acre was obtained. The rape interfered somewhat with harvesting the oats, and it was thought that the rape might have been sown three weeks after the oats to better advantage. On poorer land the rape should be sown with or soon after the oats.

Rape may also be sown in the cornfield just before the last plowing, as is often done with rye and winter wheat. Experiments at the Wisconsin Station show, however, that for conditions there this practice was not satisfactory, as the corn took the moisture that should have gone to the rape. Neither does this station recommend sowing rape with oats, as the young plants are likely to be so dried out when the crop is removed that the yield of rape is reduced.

RAPE AS A WEED DESTROYER.

Aside from its value as forage, rape is an excellent crop to grow on fields that are foul with weeds. The late date at which the seed may be sown allows the weeds to get well started before the final preparation of the soil begins; they are further kept in check by the cultivation required for the crop during its early growth, and later the rape plants shade the ground so completely as to keep the weeds down. An excellent treatment for a foul field is to plow thoroughly in late summer or early autumn and seed to rye or some other forage crop to be pastured off during the fall, winter, or early spring. When the crop has been pastured sufficiently and before the weeds have produced seed, plow again, plant rape in drills, and give thorough cultivation. There are few weeds that will survive such treatment, and the land will have given profitable returns in forage in the meantime.

RAPE AS A VEGETABLE AND AS A COVER CROP.

Rape is an excellent salad plant, and a strain is much used under the name of spring or smooth kale.

The Geneva, N. Y., Station tried rape as a cover crop for orchards, sowing 7 pounds per acre. It made good growth, but the objection was found that the plants harbor mice, which damage the trees.

It has also been tried in other States, but is not so well adapted for this purpose as other plants.

NOTES ON GROWING RAPE IN SEVERAL STATES.

In reply to inquiries valuable information regarding the growing of rape has been obtained from a large number of farmers and experimenters from which the following extracts are taken: *Idaho*: Prof. H. T. French, Moscow, says: Rape lives over winter here; unfit for forage after seed stalk develops. *Maine*: A. A. Abbott, Vassalboro, says: Rape, especially for sheep, can be used until snow comes, after all other green feed is gone. G. W. Gowell, Orono, grows rape on fertile soil for poultry. *Massachusetts*: Prof. William P. Brooks, Amherst, sows from early spring to midsummer for hogs; advises liberal supply of readily available phosphate. *Michigan*: H. M. Kingsley, Kendall, finds rape with oats hinders curing of oats; recommends for lambs. *Minnesota*: A. S. Trow, Glenville, recommends rape and grain as hog pasture; turns hogs on rape 4 to 5 inches high. Thomas Kough, Taspi, sows rape in drills for soiling, cultivates, and cuts at 2 to 3 feet. *Nebraska*: Prof. E. A. Burnett, Lincoln, says: Use of rape increased in State in past five years, especially for hog pasture, for which it is second to alfalfa or sorghum; sown in April on winter rye or wheat. *New York*: Clark Allis, Medina, sows rape with beans at last cultivation; pulls beans by hand and turns on sheep; also sows rape in orchard for sheep. William C. Buell, Holcomb, recommends rape as cover crop and lamb pasture in apple orchards. Stephen Clark, Batavia, uses rape as fall pasture for lambs and ships to market direct from pasture to avoid shrinkage. J. E. Rice, Yorktown, finds chickens prefer clover to rape. Frank D. Ward, Batavia, watches animals when first turned on rape, but after a few days does not remove them for wet or frost; in twelve years has not lost an animal from bloat; advises access to blue grass or clover. *North Dakota*: A. H. Laughlin, Lisbon, sows rape in corn at last cultivation and turns on hogs; sows with other grain to make straw valuable as fodder; sows in spring on brome-grass pasture. *Ohio*: Prof. J. F. Hickman, Wooster, thinks rape essential for fall pasture of sheep. W. O. Wing, Mechanicsburg, sows rape in corn at last cultivation, husks corn, shreds fodder, and

pastures with sheep until Christmas. *Oregon*: R. Scott, Milwaukee, drills rape about April 1, cultivates, and pastures with sheep, with movable fence; sows successively for summer and autumn. *Rhode Island*: Prof. P. W. Card, Kingston, recommends rape for geese, but considers soy beans better for hogs and cattle. *Wisconsin*: W. L. Ames, Oregon, drills rape with grass, clover, or grain. B. A. Imholt, Houlton, sows rape about April 12, cultivates at 2 inches and at 8 inches, turns on hogs at 18 to 24 inches, pastures till frost; gets ripe seed August 1. George McKerrow, Sussex, pastures chickens and pigs on rape in early summer; lambs and calves September 15 to November 1; does not give breeding ewes free access to rape. Prof. R. A. Moore, Madison, recommends rape highly; sows in drills with spring grain; pastures stock on stubble without fear of overeating. *Wyoming*: Elias Nelson, Laramie, finds rape little grown; fair experimental crop; irrigation necessary.

FARMERS' BULLETINS.

The following is a list of the Farmers' Bulletins available for distribution, showing the number, title, and size in pages of each. Copies will be sent to any address on application to any Senator, Representative, or Delegate in Congress, or to the Secretary of Agriculture, Washington, D. C. The missing numbers have been discontinued, being superseded by later bulletins.

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